ATTACHMENT 8
ENVIRONMENTAL MONITORING PLAN

8-1 General Monitoring Objectives

The Occupational Safety and Health Administration (OSHA) requirements for monitoring uncontrolled hazardous waste sites are codified in title 29, section 1910, paragraph 120 of the Code of Federal Regulations (CFR) stating that monitoring must be performed "where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to ensure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits, or other published exposure limits."

Information obtained from monitoring during the Rapid Response System (RRS) test is used to ensure that non-stockpile chemical materiel (NSCM) operations are being conducted properly and to detect any conditions that may cause a release of chemical materiel. During such conditions, monitoring data is used to:

- Alert the operators to the problem;
- Provide quantitative data to decision makers for responding to and solving the problem;
- Predict the impact of a release (such as dispersion of chemical materiel); and
- Provide historical data.

An overriding requirement of the design and development of monitoring systems has been the necessity for reliable day-to-day performance. Reliability, in this context, relates to the ability of the monitor to perform its intended function when needed.

Selection of monitoring and sampling locations is also critical to a monitoring program. The monitors must be positioned at, and samples collected from, representative points where any released chemical hazard would likely be detected. Locations for ambient air monitors must be selected to provide optimum information and maximum protection for workers.

Monitoring data collected during RRS operations varies due to different functions performed during Chemical Agent Identification Sets (CAIS) treatment and repackaging operations. Armed with this information, program personnel can determine what actions need to be taken to regain containment and/or minimize the threat of exposure to workers and the public. If an accidental release does occur, emergency response personnel will use monitoring data to determine the level of threat posed by the release, initiate emergency actions, and verify the effectiveness of measures taken to eliminate the problem.

All monitoring equipment used to support RRS operations must meet the following criteria:

- The monitoring equipment must pass an acceptance test;
- The monitoring equipment must pass the 3-day baseline study before use; and
- The monitoring system must be approved by the Project Manager, NSCM (or a designee) and the Utah Division of Solid and Hazardous Waste (DSHW).

8-1-1 Acceptance Testing Requirements

Acceptance testing demonstrates the ability of the equipment to properly collect, detect, and quantitative the CAIS chemical compound of interest. Acceptance tests are performed on the following RRS test sampling equipment:

- Depot Area Air Monitoring System (DAAMS) tubes;
- Preconcentrator tubes (PCTs);
- MINICAMS®;
- RAMAN spectrophotometer; and
- Hewlett Packard (HP) Dynatherm gas chromatograph (GC).

The acceptance test pass/fail criteria for the DAAMS tubes and PCTs has been specified by the Program Manager for Chemical Demilitarization (PMCD). The acceptance test criteria for MINICAMS® and HP Dynatherm GCs have also been established by PMCD in the RRS technical specification package for the RRS air monitoring systems.

If the equipment passes the acceptance test, then it is included in the 3-day baseline study. If the equipment fails the acceptance test, then it is not used in support of the RRS test. Equipment that fails an acceptance test may be retested at any time. Acceptance tests are only required to be passed once for each analyte and specific location the equipment is designed to monitor. If the equipment is used to monitor for five different chemicals, then it must successfully pass an acceptance test for each of the five chemicals.

8-1-2 Baseline Monitoring Requirement

The 3-day baseline study demonstrates the readiness of the instrument, method, and personnel to properly monitor for the chemicals of interest in samples collected at the RRS test site. The 3-day baseline study includes the Nonstockpile System Contractor (NSSC) monitoring team and mobile analytical support platform (MASP) operators. The baseline study is also used to identify the existence of any instrument operation problems, background interference, and sampling logistics problems. The baseline study will be performed for 3 consecutive days in Building 4553 before the RRS test site receives the first CAIS materiel for processing. Simulated RRS operations are conducted throughout the baseline study period.

At the start of the 3-day baseline study, the laboratory and monitoring equipment is first calibrated. During the 3-day baseline study, all monitoring equipment is operated and challenged in accordance with the Quality Control Plan (QCP) as if actual CAIS were being processed. The confirmation samples are also collected and analyzed. The QC samples and heated sample transfer line challenges are performed on the first day of the 3-day baseline study. The MINICAMS® units are calibrated on the first day and challenged daily thereafter.

The MASP operators calibrate all MASP laboratory (Figure 8-1) analysis equipment, and receive, prepare, and analyze air samples from the site. During the 3-day baseline study, air samples collected in the field, both routine samples and QC samples, are analyzed. Sample analysis during the 3-day baseline study is necessary to demonstrate in-control performance of all monitoring systems and to identify the presence of any interference in the samples or the sample collection and analysis procedures.

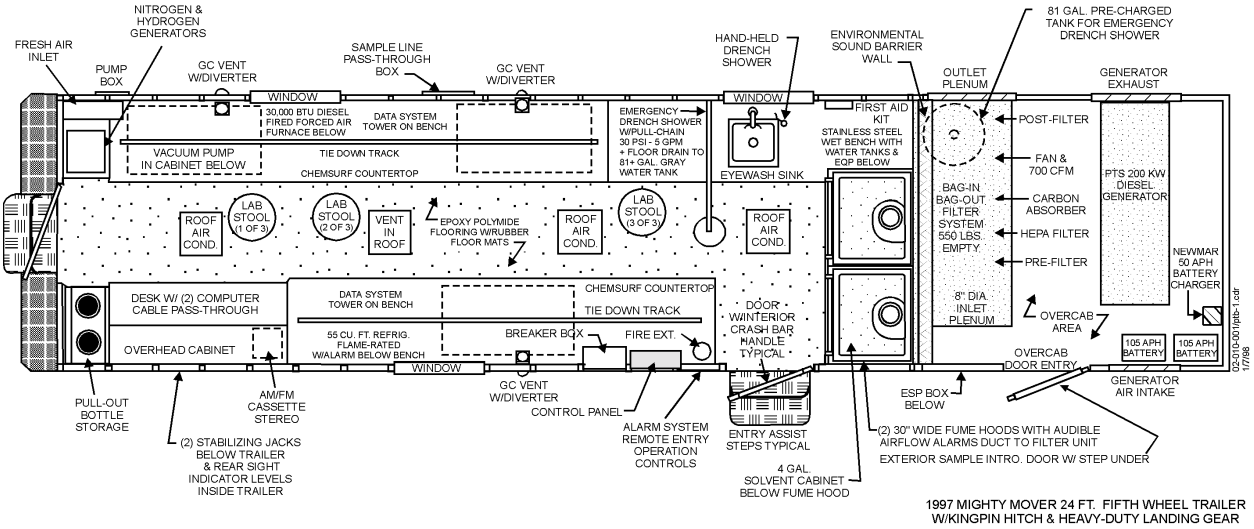

Figure 8-1.
Rapid Response System Mobile Analytical Support Platform

Representative QC samples are analyzed and recorded during the 3-day baseline study and during routine operations thereafter.

To pass the 3-day baseline study, the following criteria must be met:

- All site monitoring equipment must meet the calibration and challenge acceptance requirements;
- All monitoring equipment used in support of RRS test sample analysis [MINICAMS®, composite liquid waste samplers (coliwasa), drum thieves, etc.] must be used during the baseline study;
- Only trained monitoring equipment operators operate the monitoring equipment;
- The number of samples collected, method of sample collection, and sample collection procedures must be in accordance with the QCP;
- The MASP must receive and analyze samples from the site that represent at least 2 days of sampling;
- All MASP equipment used in support of RRS test sample analysis must be used during the baseline study; and
- All MASP equipment must meet the calibration and QC sample acceptance requirements stated in the QCP.

8-2 Monitoring Systems Used to Support Rapid Response System Operations

Air monitoring results from the RRS test site are analyzed to ensure that operations are being conducted in a safe manner and in compliance with the RRS Resource Conservation and Recovery Act (RCRA) operating permit. Air monitoring results are also analyzed to detect any conditions that may cause workers to be exposed to chemical vapors from CAIS.

The monitoring data from RRS test monitoring operations are used to verify compliance with OSHA, U.S. Environmental Protection Agency (USEPA), Utah Division of Solid and Hazardous Waste (DSHW), and Department of the Army (DA) regulations.

Field air monitoring procedures rely on three specific types of monitoring:

- o Near real-time (NRT) air monitoring
- o Confirmation air monitoring
- o Historical air monitoring.

Figure 8-2 illustrates the MINICAMS® monitoring system flow diagram for RRS operations. The monitoring equipment used to quantitate an analyte is calibrated by the NSSC with calibration standards.

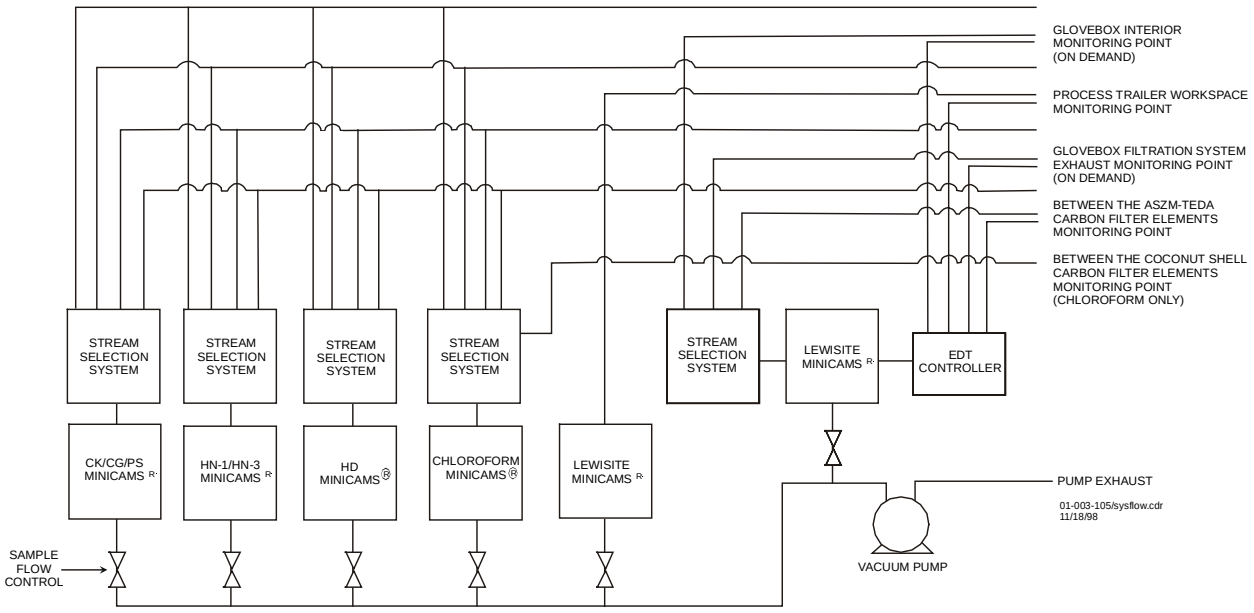

Figure 8-2
MINICAMS® Monitoring System Flow Diagram

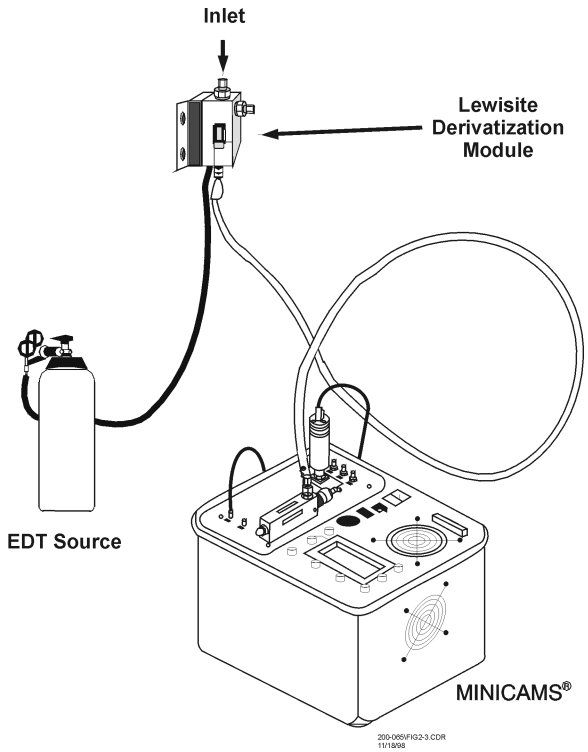

Figure 8-3
Lewisite MINICAMS® Setup

8-2-1 Near Real-Time Air Monitoring Systems

MINICAMS® units are used to monitor RRS operations. The rack mounted MINICAMS® are set to alarm at 0.2 chemical control limit (CCL) for each of the vaporous chemical materiel, except for the Lewisite MINICAMS, which will alarm at 0.5 CCL. These MINICAMS® provide early, rapid warning of airborne exposure hazards inside the operations trailer.

Equipment Description. The MINICAMS® consist of a monitor (sample collection, analysis, detection, and alarm equipment), a vacuum pump, heated sample transfer lines, compressed gases, a stream selection system, a floppy disk drive, and a short range modem.

Analytical Monitoring Method. The MINICAMS® is GC that operates by alternating between sampling and analysis cycles. During the sample cycle, a vacuum pump pulls an air sample into the MINICAMS® through a solid sorbent tube or into a sample loop where the analytes are collected. Heated sample transfer lines [heat-traced Teflon tubing that maintains the sample temperature between 50^0 and 100^0C (122^0 and 212^0F)] ensure that chemical materiel being transported down the sample line does not condense, become entrapped in any moisture that may have collected in the lines, or become adsorbed onto the walls of the Teflon sample line.

During the analysis cycle, the solid sorbent tube is heated to thermally desorb the analytes, and nitrogen flows into the sorbent tube to carry the analytes into the capillary column for separation. The sample loop is maintained at a constant 75^0C to prevent condensation; after sample collection, it is flushed with nitrogen in order to carry the analytes into the capillary column. The separated analytes are then carried to the detector. Compressed hydrogen and air fuels the flame of the flame photometric detector (FPD). Air is used as the reducing agent for the halogen selective detector (XSD). Nitrogen is used as the carrier gas to push the desorbed sample off the solid sorbent tube or through the sample collection loop and then through the capillary column to the detector. The signal from the detector is analyzed to identify and quantitate any chemical materiel that is present in the sample. If the concentration of the chemical materiel detected is at or above the alarm setpoint, then the MINICAMS® alarm is activated. The combined sample and analysis time varies from 3 to 10 minutes, depending upon the MINICAMS® configuration.

A stream selection system accompanies each of the operations trailer's MINICAMS® that support Rapid Response System operations (Figure 8-2). The stream selection system allows each MINICAMS® to collect samples from different sample locations as appropriate. Each of the rack mounted MINICAMS® units has a different configuration, allowing simultaneous monitoring of all eight CAIS chemicals.

The short-range modem allows the MINICAMS® information to be sent to a computer for electronic data storage in the MINI-NET database.

The MINICAMS® automatically sends a concentration report to the printer/floppy disk drive at the closing of the last gate. The concentration report includes the date, time, instrument number, sampling port number, error codes (if activated), chemical materiel identity, summary, MINICAMS® operational mode (RUN, CAL, SER, etc.), and the chromatographic information. At the beginning of each RRS operational day, the concentration report is collected from the printer, reviewed, and filed in the RRS air monitoring files.

The concentration reports are backed up on disk and stored separately. All Rapid Response System monitoring files are maintained as part of the operating record and are kept onsite.

The MINICAMS® also has the capability through the enunciator panel to activate a malfunction alarm if the system operates outside of parameter limits (flow, temperature, time, etc.) established by the operator. Figure 8-4 illustrates a MINICAMS® sample station.

Calibration Requirements. The MINICAMS® will be calibrated on the first operational day of each week of RRS site operations and whenever two consecutive daily challenges at 1.0 CCL or TWA are outside of ±25 percent of the target value. At the beginning of all subsequent operational days of each week, every MINICAMS® will be challenged at the 1.0 CCL or TWA hazard level. Wastes generated by calibrating and challenging the MINICAMS® are handled as a hazardous waste and packaged in accordance with OSHA, USEPA, State of Utah DSHW and Department of Transportation (DOT) regulations. Agent MINICAMS will be calibrated at 1.0 CCL or TWA and challenged at the alarm level and 1.0 CCL or TWA. Industrial MINICAMS® will be challenged at 1.0 TWA.

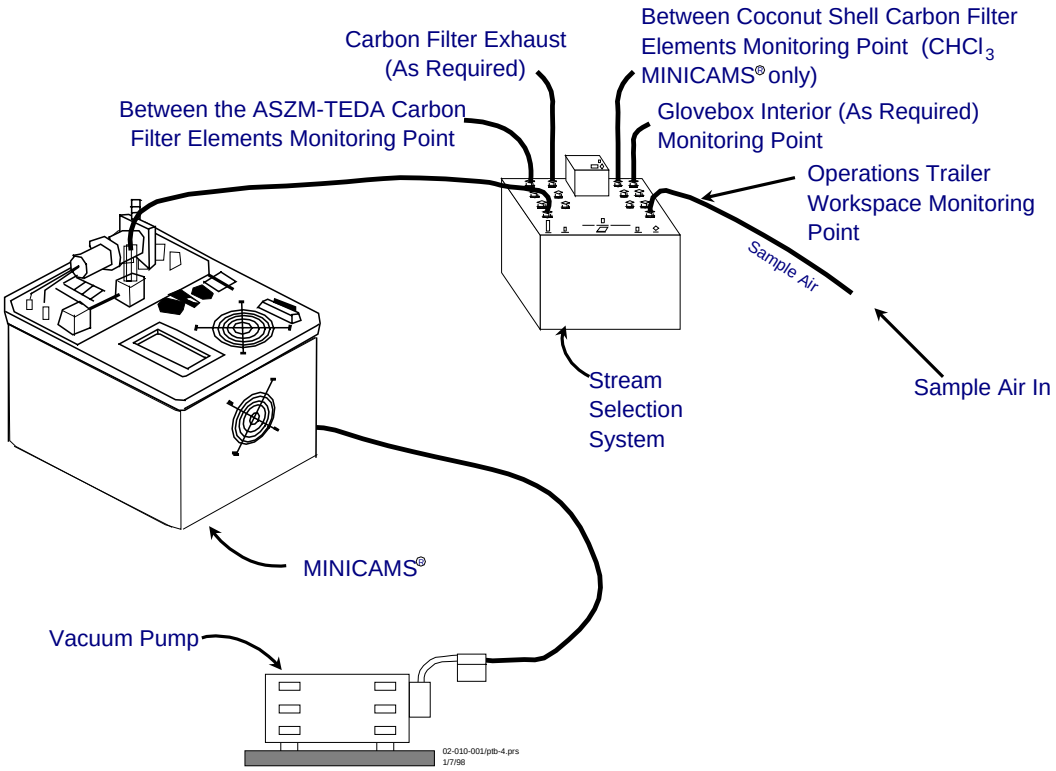

Figure 8-4
MINICAMS® Sample Station Example

Monitoring Locations. The MINICAMS® is the primary ambient air monitor for the RRS. The MINICAMS® units operate until RRS test operations at Building 4553 are concluded. The MINICAMS® heated sample transfer line in the operations trailer is connected to a stream selection system, which allows each MINICAMS® to monitor from each specified sample port.

The rack-mounted MINICAMS® units cycle between the sample collection points for the Rapid Response System. There are five MINICAMS® sample collection points for the Rapid Response System:

- Between the ASZM-TEDA carbon filter elements;
- Between the coconut shell carbon filter elements;
- Inside of the RRS operations trailer workspace;
- In the interior of the RRS operations trailer glovebox;
- Carbon filter system exhaust of the operations trailer. MINICAMS in the operations trailer are spooled to the exhaust when an alarm in the midbed is activated.

The area between the ASZM-TEDA carbon filter elements and the operations trailer workspace area will be sampled alternately with the MINICAMS® for HD, nitrogen mustard (HN-1/HN-3), lewisite (L), chloropicrin (PS), cyanogen chloride (CK), and phosgene (CG). The area between the coconut shell carbon filter elements and the operations trailer will be sampled alternately with a MINICAMS® for $CHCl_3$. The carbon filter exhaust will be sampled and analyzed with historical DAAMS during operational hours in accordance with paragraph 8-2-3 from the start of operations until the closure of the glovebox. The filter midbed will be sampled with MINICAMS, with DAAMS confirmation, at all times from the start of operations until the closure of the glovebox.

At the three alternately sampled locations, the MINICAMS® alarms are confirmed by:

- Collocated confirmation DAAMS tubes for L, HD, and HN-1/HN-3 alarms
- Colorimetric tubes for PS, CG, CK, and $CHCl_3$ alarms.

8-2-2 Alarm Confirmation Sample Systems

The alarm confirmation sample systems are collocated with the MINICAMS® and are used to confirm a MINICAMS® alarm.

The MINICAMS® alarm system is used to warn RRS personnel that the chemical may be outside of engineering controls at a level equal to or greater than the alarm set-point. The confirmation sample is collected and analyzed to determine the validity of the MINICAMS® alarm. If the confirmation sample analysis result does not indicate the presence of the chemical, then the alarm is considered a false alarm. If the confirmation sample analysis result does indicate the presence of the chemical, then the alarm is considered valid and is a confirmed alarm result. The alarm confirmation sample results must be reported verbally to the RRS Supervisor, Deseret Chemical Depot (DCD), and the Site Safety and Health Officer (SSHO), as soon as possible; a hard copy of the sample analysis results and calculations should also be provided as soon as possible. Deseret Chemical Depot will report all confirmed alarms to DSHW within 24 hours of confirmation. All MINICAMS alarms will be verified by a DAAMS tube or colorimetric tube for confirmational purposes. Alarms associated with challenges or calibration are not subject to DAAMS tube or colorimetric tube confirmation. If a confirmation tube is not available for analysis, the alarm is deemed confirmed.

The response to MINICAMS® alarms is specifically addressed in the RRS test standard operating procedures (SOPs) and safety plans. If the MINICAMS® alarm is confirmed to have detected CAIS materiel concentrations greater than or equal to the alarm setpoint outside of engineering controls, then the DCD Operations Center, and in turn the Project Manager, NSCM, are notified immediately. DCD will be notified of all alarms and the confirmation sample analysis results in compliance with their Chemical Accident/Incident Response and Assistance Plan (CAIRAP).

Depot Area Air Monitoring System Equipment Description. The DAAMS tubes are used as an alarm confirmation sample and as a historical monitoring system. The DAAMS consists of a vacuum pump, sequencer, and DAAMS sample tubes. After collection, the DAAMS tubes are analyzed in the MASP using a HP Dynatherm GC. The DAAMS sample tube is a glass tube packed with solid sorbent materiel used to trap airborne chemicals in the air sample (Figure 8-5). DAAMS tubes will be uniquely identified by an alphanumeric code. The solid sorbent is selected specifically to trap the chemical compound of interest. A vacuum pump is used to draw the air sample through the DAAMS sample tube. A sample set is comprised of two DAAMS tubes for HD, HN-1, HN-3, and L, one of which is analyzed for the agent that caused the alarm.

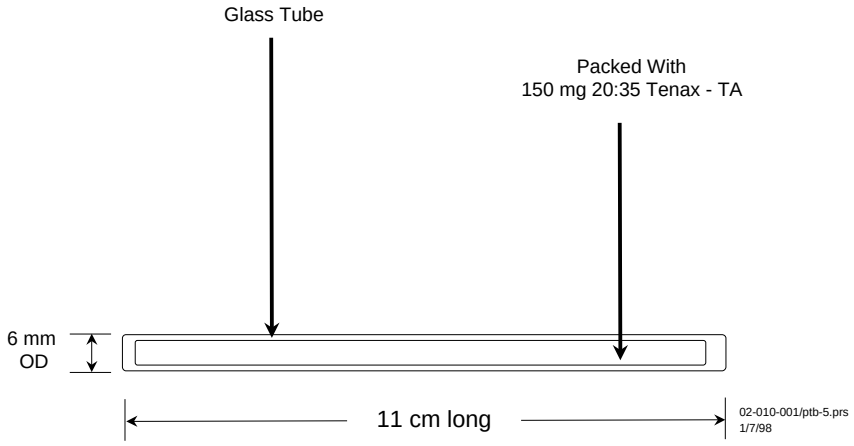

Figure 8-5
DAAMS Tube for HP Dyantherm Analysis

For RRS test operations, an HP Dynatherm sample tube and analysis station, included as standard equipment in the MASP, is used in place of the DAAMS, but is still referred to as a DAAMS sample tube and DAAMS sample station. Figure 8-6 illustrates a DAAMS sample station.

Depot Area Air Monitoring System GC Analytical Method. After the DAAMS sample is collected, it is sent to the MASP for analysis. The DAAMS sample tube is inserted directly into a HP Dynatherm GC (Figure 8-7). After the DAAMS tube is inserted into the Dynatherm sample holder, the sorbent tube is heated, and the chemical materiel is thermally desorbed. Nitrogen or helium flows through the heated DAAMS tube to carry the chemical materiel into the capillary column for separation.

After the chemicals are separated in the capillary column, they are carried to the detector. The detector signal is analyzed to identify and quantitate the amount of chemical materiel present in the sample. The results of the sample analysis are printed. The HP Dynatherm operator interprets the sample results by comparing the sample results to the current calibration curve data.

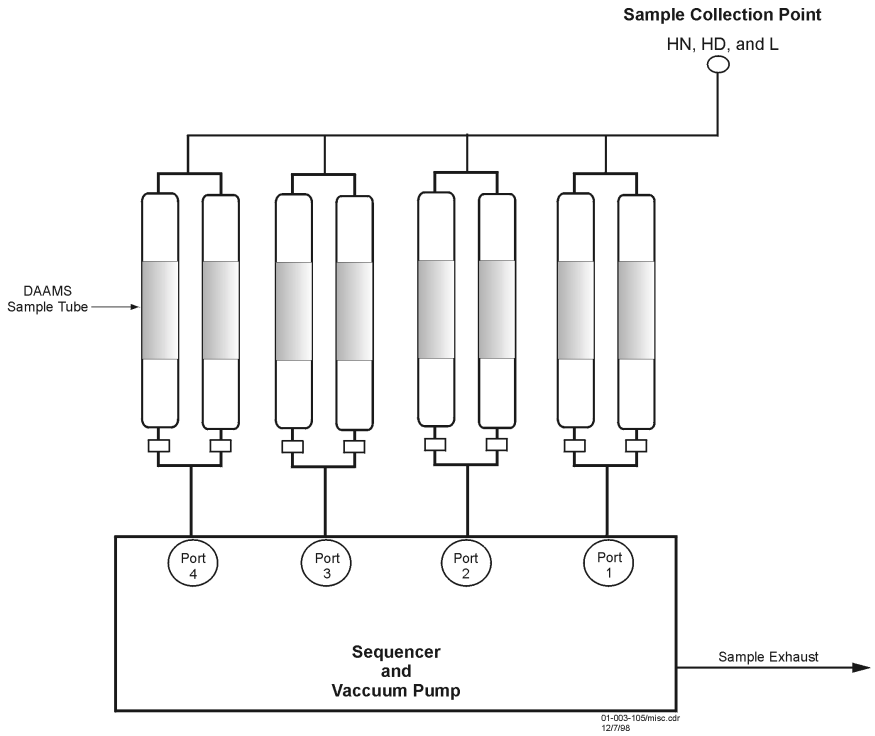

Figure 8-6
DAAMS Sample Station

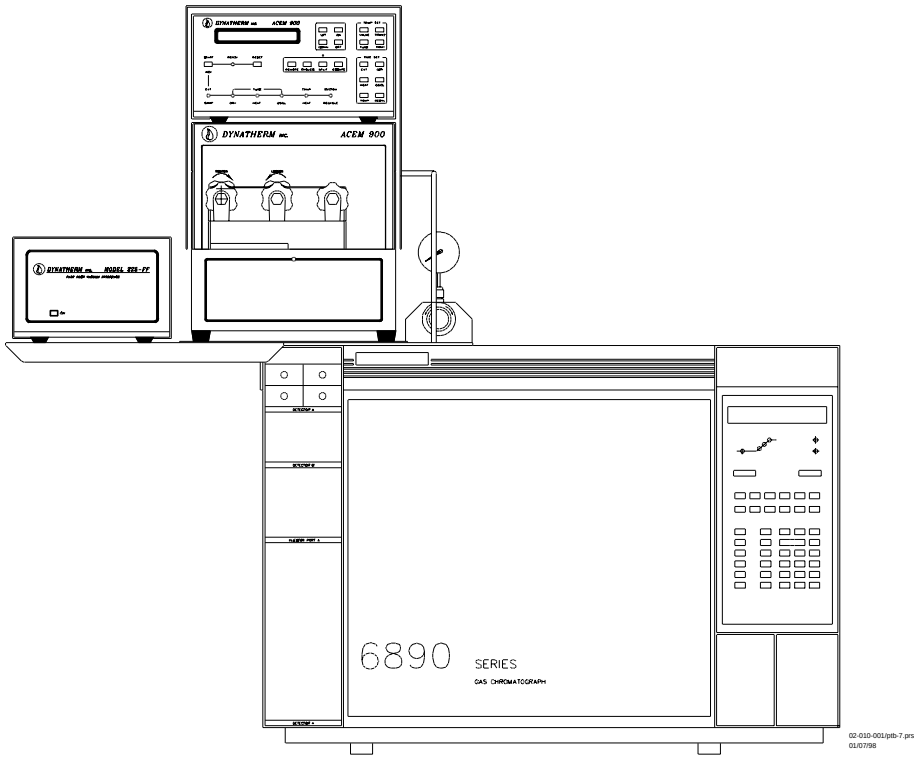

Figure 8-7
HP Dyantherm Gas Chromatograph

Colorimetric Tubes Equipment Description. Colorimetric tubes are used for confirmation monitoring of CG, CK, PS, and $CHCl_3$ vapors and to check qualitatively for successful decontamination of HD, HN-1/HN-3, and L. The colorimetric tube sampling system consists of a colorimetric tube and a hand pump. The hand pump is used to draw a known volume of air into a tube containing a specific chemical sorbent selected to detect a single chemical compound or class of compounds in the air. Different tubes are required to monitor for different chemicals. Colorimetric tubes from Draeger, Sensidyne, ENMET, or equivalent may be used during RRS operations if tested during the baseline study. The sample period for the hand-pumped colorimetric tubes is measured in terms of pump strokes and usually is 2 to 3 minutes per stroke. Figure 8-8 illustrates colorimetric tube sample equipment.

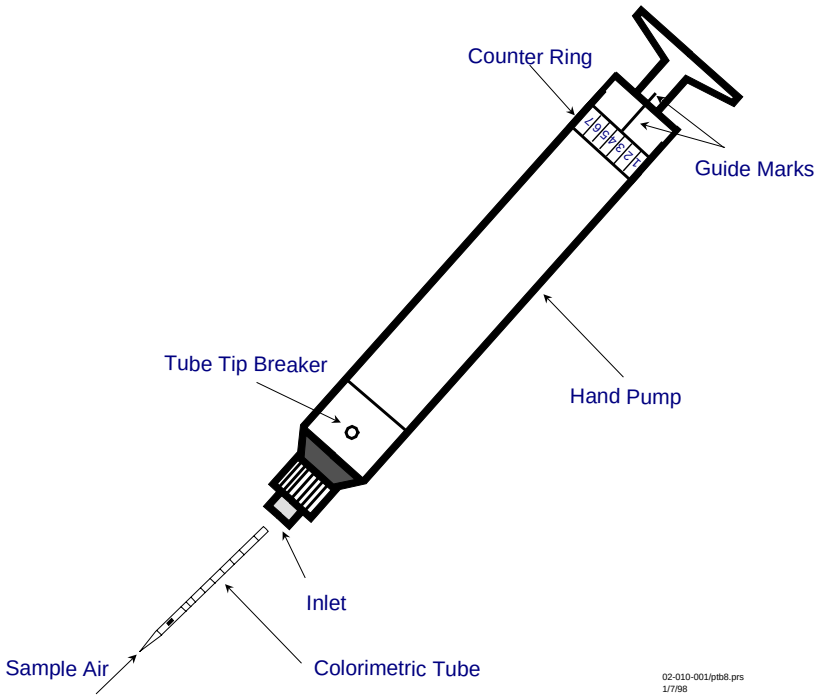

Figure 8-8
Colorimetric Tube Sampling Equipment

Colorimetric Tube Analytical Method. If the compound being monitored is present in the air sample drawn through the tube, the compound chemically reacts with the sorbent inside the tube to create a visible color change. The colorimetric tubes are inspected visually immediately after sample collection to determine the length of color change that was produced. The tubes are used once and then disposed of appropriately. Each tube has an instruction sheet provided with the tube that states exactly how many pump strokes are performed when collecting the sample.

8-2-3 Historical Sample Collection Systems

Historical sample collection systems are DAAMS sample stations located at the system exhaust, the Operations Trailer workspace, and the MASP workspace and filter midbed. The historical samples are collected and analyzed continuously during operational hours. DAAMS historical samples for mustards (HD, HN-1 and HN-3) are collected and analyzed using a single tube. L is collected and analyzed using a second tube. At a minimum, one QP sample is collected and analyzed per location per day with the corresponding DAAMS historical samples for each agent. QP sample tubes are pre-spiked (one tube HD, HN-1, HN-3; one tube L) and then placed at the sample port for the same duration as the corresponding historical sample.

8-2-4 Raman Spectrophotometer

A Raman spectrophotometer with fiber-optic probe is used to segregate CAIS glass ampules or bottles for treatment or repackaging, as they are unpacked inside the glovebox. An ampule or bottle is removed from any overpack and placed inside a fixed-position holder with matching cover. The side of the ampule or bottle is placed against a fiber-optic probe, which is fixed in position below eye level inside the glovebox. After the sample has been positioned correctly, the Raman spectrum is recorded using laser excitation of the sample. Light emitted from the sample is collected in the collection optics of the fiber-optic probe, and the Raman spectrum is recorded electronically and printed. Corresponding instrument parameters are also recorded. The resulting spectrum is compared to an online library of spectra for each of the potential CAIS chemical solutions.

8-2-5 Colorimetric Tubes Acceptance

Colorimetric tubes (one for each industrial chemical) will be challenged upon receipt at the RRS site. The challenges for each chemical will be perfomed once per month when the lot is in use and once per shipment of each tube lot. A tube lot will consist of a maximum of 200 colorimetric tubes.

8-3 Monitoring Standards and Control Limits

Chemical materiel contamination of air, soil, and water can present a significant threat to the safety of workers, the public, and the environment during the RRS test. Federal and military agencies require monitoring for the release or presence of hazardous chemicals in ambient air during transportation, storage, and disposal of chemical warfare materiel (CWM). During emergency response activities, to confirm that RRS workers and the surrounding communities are not exposed to hazardous conditions as a result of RRS test operations.

Contamination of the ambient air with HD, HN-1/HN-3, L, CK, CG, PS, or $CHCl_3$ vapors may present a hazard if the concentration of airborne contaminants rises above the levels indicated in Table 8-1. The Surgeon General establishes the CCL values for each chemical for agents. The TWA for workplace activities are established by the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), and the American Conference of Governmental Industrial Hygentists (ACGIH) for the industrial chemicals.

For H, HN-1, and HN-3, 20 percent of the CCL value is used and, for Lewisite, 50 percent of the CCL value is used as the alarm setpoint for the MINICAMS® that are used to monitor for the compound during RRS operations at the test site.

Table 8-2 provides a summary of action levels and air monitoring equipment to support RRS test operations.

Table 8-1.
RRS Industrial Chemical and Chemical Agent Monitoring Standards and Chemical Control Limits

Name	Abbreviation	Classification	Workplace Exposure Limit[a]
Adamsite	DM	Industrial chemical	Not specified (solid)
alpha-Chloroacetophenone	CN	Industrial chemical	0.32 mg/m^3
Chloroform	$CHCl_3$	Industrial chemical	9.7 mg/m^{3b}
Chloropicrin	PS	Industrial chemical	0.7 mg/m^{3c}
Cyanogen chloride	CK	Industrial chemical	0.6 mg/m^{3d}
Lewisite	L	Chemical agent	0.003 mg/m^{3e}
Mustard	H, HD	Chemical agent	0.003 mg/m^{3e}
Nitrogen mustard - 1	HN-1	Chemical agent	0.003 mg/m^{3e}
Nitrogen mustard - 3	HN-3	Chemical agent	0.003 mg/m^{3e}
Phosgene	CG	Industrial chemical	0.4 mg/m^3

Notes:

[a] Values for the workplace exposure limit cited from the USACMDA Site Monitoring Concept Plan, July 1994, Rev. 0.

[b] This is the short-term exposure limit (STEL) for chloroform. The STEL for chloroform is for 60 minutes.

[c] NIOSH, June 1994. The NIOSH recommended limits (RELs) are listed in this table. Unless otherwise noted, RELs are time-weighted-average (TWA) concentrations for up to a 10-hour workday during a 40-hour workweek.

[d] This is a ceiling value. A ceiling value should not be exceeded at any time.

[e] These values are Chemcial Control Limits (CCLs), defined as the concentration of a specified chemical that, when met or exceeded at a designated sampling point, requires cessation of CAIS treatment activities and implementation of emergency procedures and corrective action. No personnel may reman in atmosphere meeting or exceeding the Chemical Control Limit without wearing appropriate protective equipment.

Table 8-2.
Rapid Response System CCL and Air Monitoring Equipment

Chemical	CCL and TWA (mg/m^3)	MINICAMS® Number	Detector	Response Time (min)	Confirmation Method
HD	0.003	2	FPD	6	DAAMS (GC/FPD or MSD)
HN-1/HN-3	0.003	4	XSD	6	DAAMS (GC/XSD, MSD, or NPD)
L	0.003	5	Derivative; XSD	10	DAAMS (GC/XSD or MSD or FPD)
CK	0.6	3	XSD	3	Colorimetric tube
CG	0.4	3	XSD	3	Colorimetric tube
PS	0.7	3	XSD	3	Colorimetric tube
Chloroform ($CHCl_3$)	9.7	1	XSD	4	Colorimetric tube

Notes:
FPD = Flame photometric detector
GC = Gas chromatography
mg/m^3 = milligram(s) per cubic meter
MSD = Mass selective detector
NPD = Nitrogen phosphorous detector
CCL = Chemical control limit
TWA = time-weighted average
XSD = Halogen selective detector

8-4 Sample Collection Locations

The RRS vapor samples are collected from the following locations:

- Operations trailer workspace,
- Interior of the RRS glovebox,
- Between the coconut shell carbon filter elements of the carbon filter system,
- Between the ASTM-TEDA filter elements of the carbon filter system,
- Carbon filter system exhaust, and
- MASP work space and filter midbed.

To ensure representative samples are collected, samples must be collected in properly cleaned containers, promptly and properly preserved, and transported to the MASP so that the chance for significant changes in constituents is minimized. Proven sampling, preservation, and shipping methods that comply with USEPA and DOT specifications are used. Samples sent offsite are packed with appropriate transportation labels (hazardous waste and DOT hazard labels, when appropriate). The sample is accompanied by the chain-of-custody (COC) forms. The NSSC monitoring team is responsible for proper sample collection, documentation, preservation, and transportation.

All samples are collected, contained, preserved, transported, received, prepared, and analyzed in accordance with the most recent USEPA guidance, including Solid Waste Methods (SW846, USEPA), and Samples and Sampling Procedures for Hazardous Waste Streams [USEPA, American Society for Testing and Materials (ASTM) methods, and RRS QCP]. Specific procedures are established by NSSC and MASP monitoring teams.

8-4-1 Operations Trailer Workspace

The MINICAMS® sample collection point inside the RRS operations trailer workspace (Figures 8-9 and 8-10) is used to identify any CAIS chemical compounds outside of engineering controls from the glovebox or the carbon filter unit located in the same trailer. Air samples are collected from a point as close as possible to the breathing zone area of the glovebox operators.

The sample collection point at the RRS workspace for the MINICAMS® units will include the placement of the inlet: (1) to the L MINICAMS® derivatization module heated sample transfer line above the glovebox; and (2) to a second heated sample transfer line connected in the MINICAMS® rack to the PS, CK, CG, HD, HN-1/HN-3, and $CHCl_3$ MINICAMS® stream selection systems.

The DAAMS confirmation sample collection point inside the RRS operations trailer workspace is used to confirm a MINICAMS® workspace alarm. It is critical that the DAAMS sample collection point and the colorimetric tube sample collection point collect samples that are as close as possible to the MINICAMS® sample collection point.

Sample ports are available on the historical DAAMS sample station for the daily quality plant (QP) sample of HD, HN-1, and HN-3. Historical DAAMS tube samples are collected only during operational hours. QP samples are sampled and analyzed with every sequence of DAAMS tubes for Lewisite.

8-4-2 RRS Glovebox Interior

The MINICAMS® sample collection point inside the RRS glovebox is used to confirm that the glovebox or material being removed from the glovebox has been decontaminated adequately to a level less than the CCL (Table 8-2). The MINICAMS® is not set up routinely to monitor this sample port but is connected during the end-of-operations decontamination activities[1]. The MINICAMS® and DAAMS should not be exposed to samples with high moisture or high pH due to the effects of water and basic chemicals on the PCT and the capillary column. To ensure that the MINICAMS® and confirmation stations are not damaged by high moisture or very high pH (greater than 10), the operator must ensure the glovebox has been rinsed and dried before being sampled. Figure 8-12 shows the location of the monitoring ports in the glovebox system.

[1] If the MINICAMS® monitors routinely sampled the glovebox, the detector would become saturated and inoperable at the concentrations of chemicals generated during normal glovebox operations.

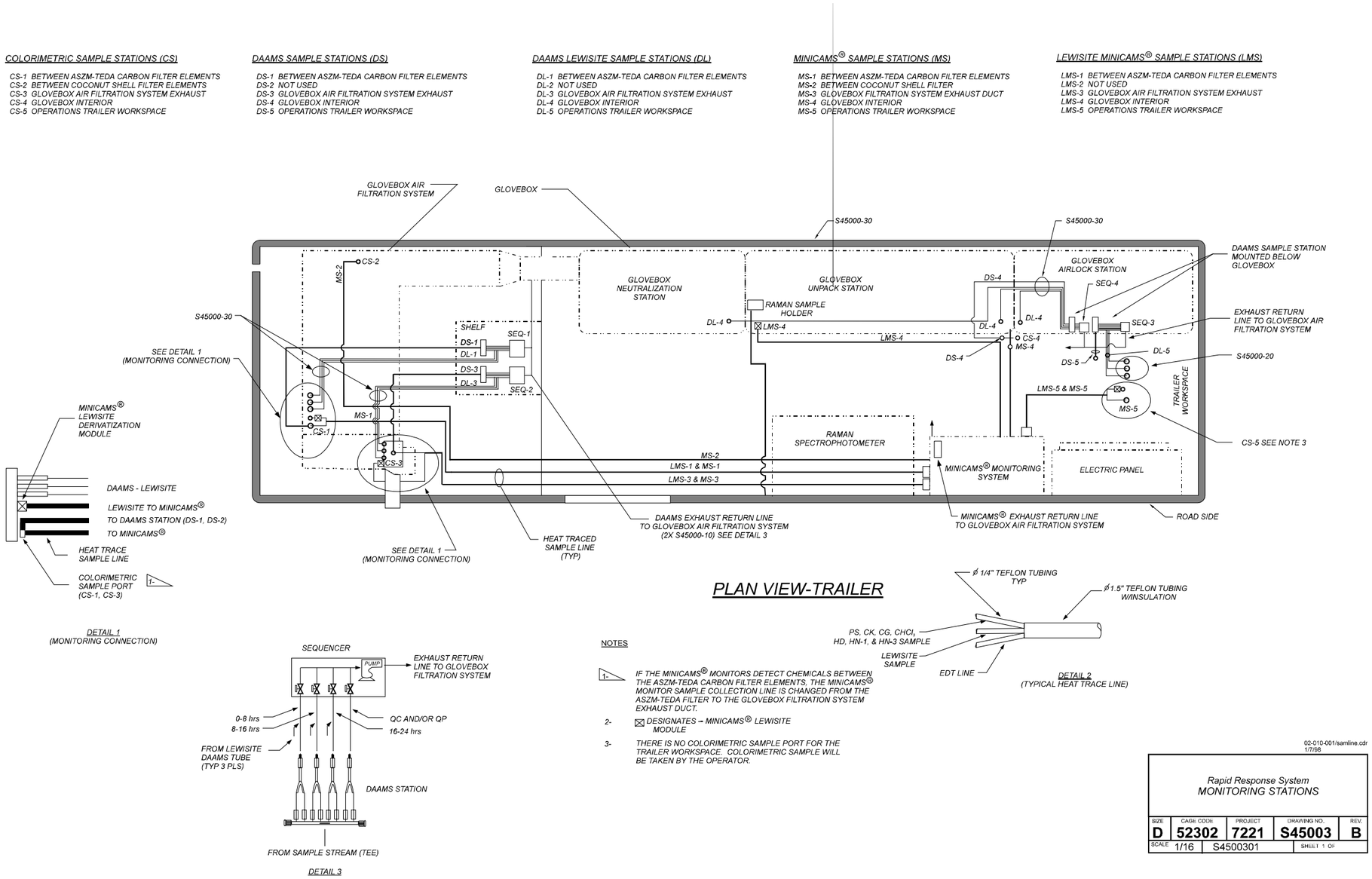

Figure 8-9
MINICAMS® Sample Line Locations

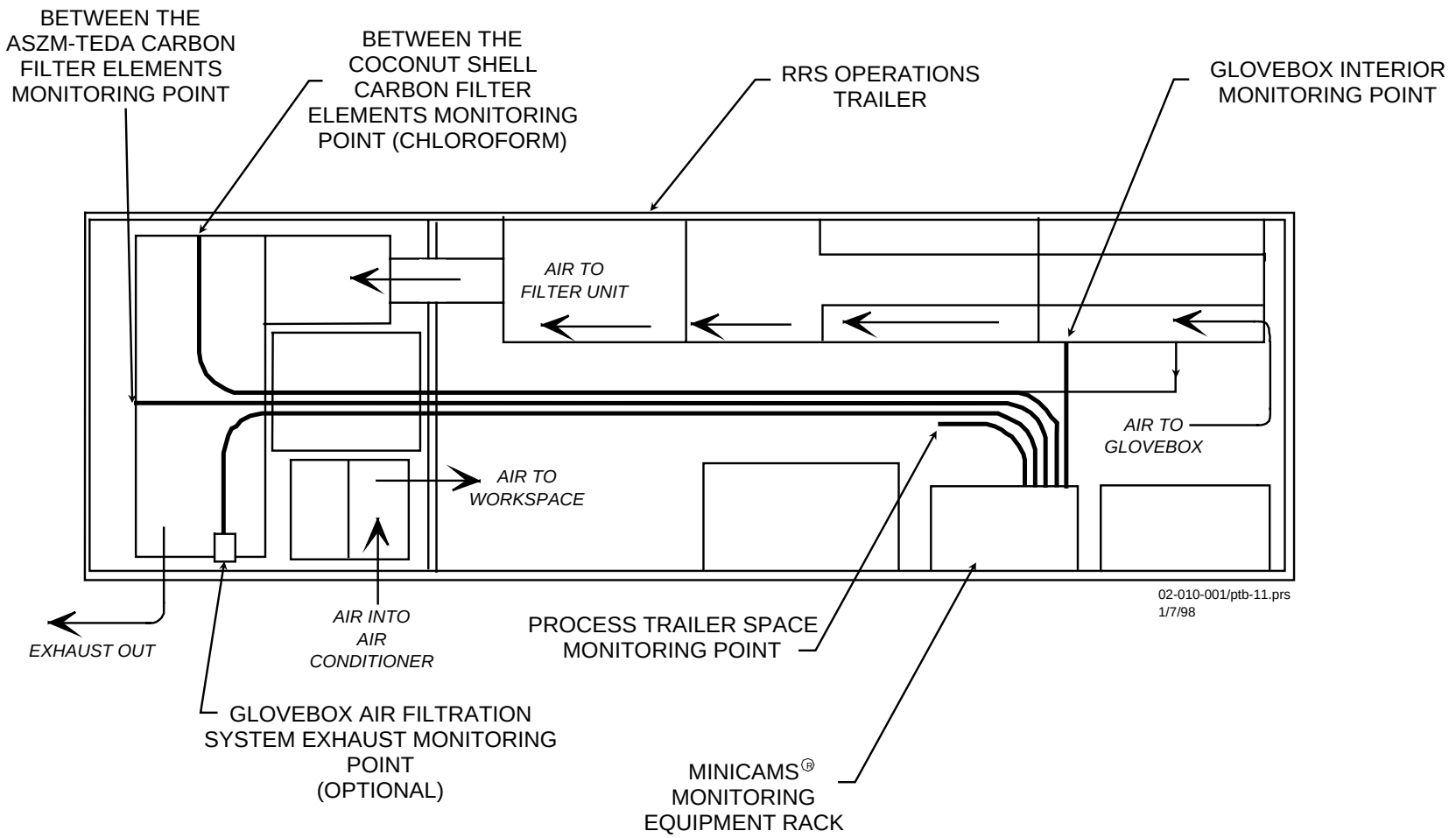

Figure 8-10
MINICAMS® Sample Line Locations and Air Flow Diagram for the RRS

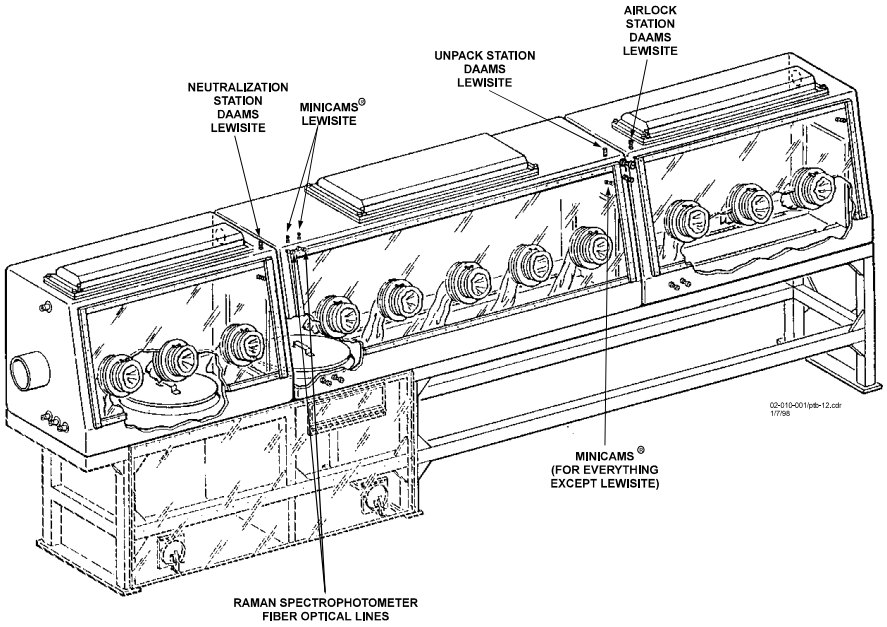

Figure 8-1
Monitoring Ports on the Glovebox System

8-4-3 Between the Coconut Shell Carbon Elements

The MINICAMS® sample collection point between the coconut shell carbon filter elements is used to identify breakthrough of any $CHCl_3$ past the first coconut shell carbon element in the filter (Figure 8-10). Figures 8-12 and 8-13 are illustrations of the carbon filter system.

The sample collection point consists of one penetration into the filter system housing that is split into a tee on the outside of the filter bank housing. One leg of the tee is connected to the sample transfer line for the $CHCl_3$ MINICAMS®. The second sample leg is capped off and used to collect $CHCl_3$ confirmation samples to confirm a MINICAMS® alarm on an as-needed basis.

The colorimetric tube confirmation sample collection point between the coconut shell carbon filter elements is an alarm confirmation sample collected from a sample point collocated with the MINICAMS® sample point to confirm a $CHCl_3$ alarm, if necessary. The location of the monitoring point between the elements of the coconut shell carbon filter is shown in Figures 8-13 and 8-14.

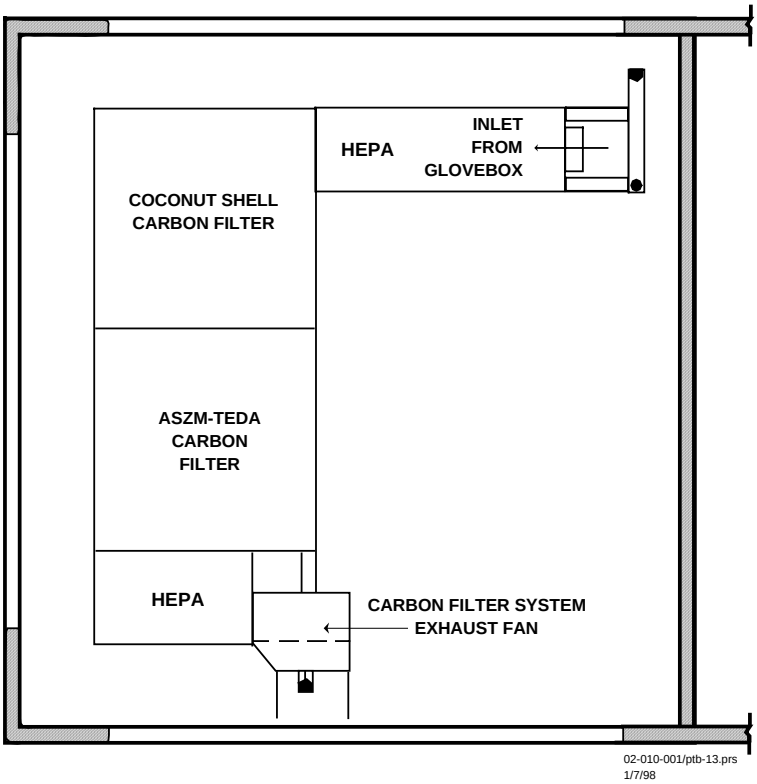

Figure 8-12
RRS Carbon Filter System

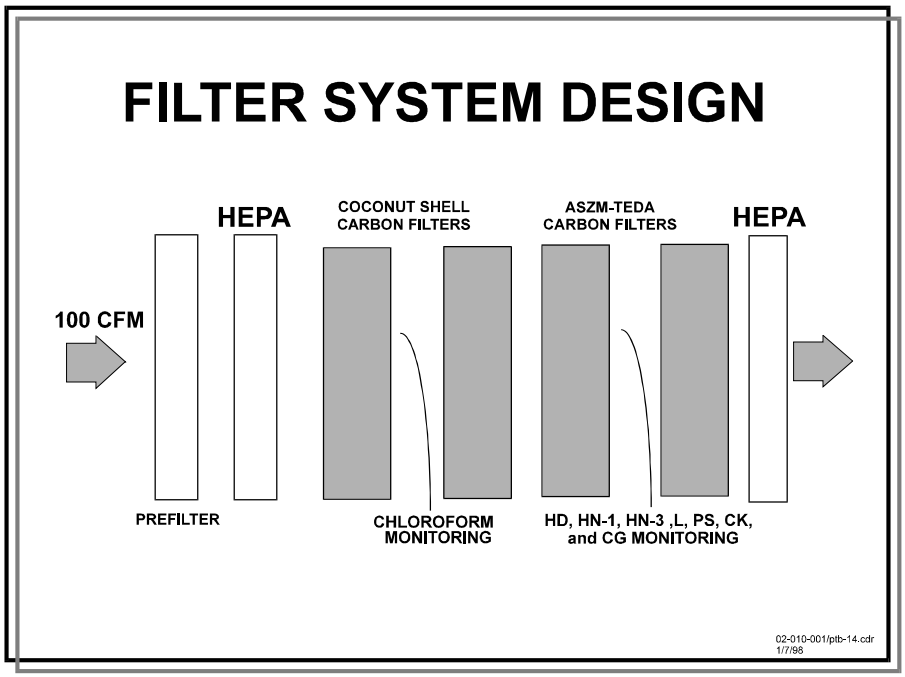

Figure 8-13
Carbon Filter System Flow Diagram

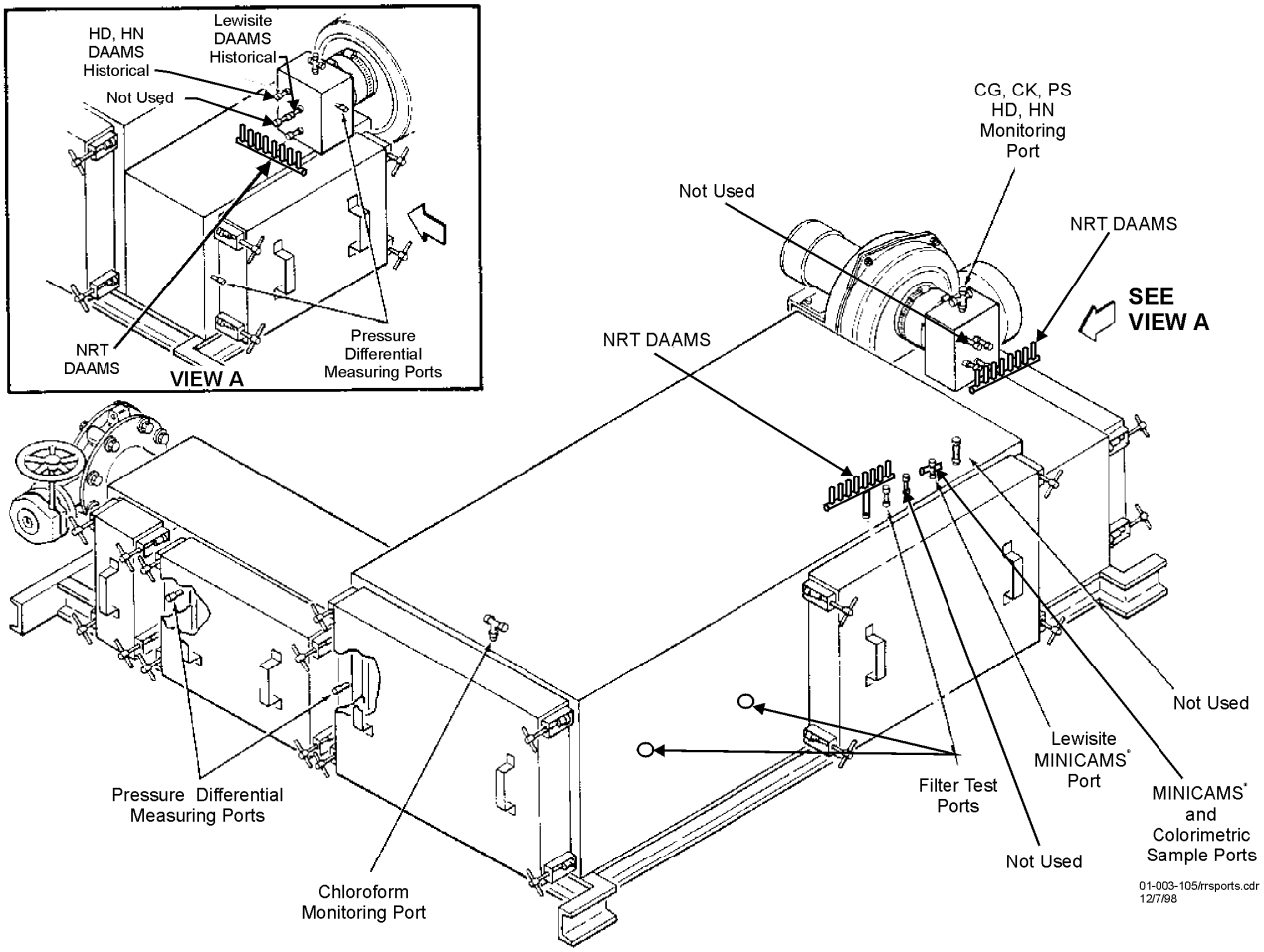

Figure 8-14
Monitoring Ports on the Glovebox Air Filtration System

8-4-4 Between the ASZM-TEDA Carbon Filter Elements

The MINICAMS® sample collection point between the ASZM-TEDA carbon filter elements is used to identify breakthrough of any CAIS chemicals past the first ASZM-TEDA element. It is critical that the sample collection port between the ASZM-TEDA carbon filter elements collect a sample that is representative of the air stream across the entire face of the ASZM-TEDA carbon filter. The use of a sample probe that collects a sample from a cross-sectional area of the carbon elements is required for all chemicals except L. L MINICAMS® samples are collected using a derivatization module. L MINICAMS® samples are collected through the filter housing.

The confirmation sample is collected from a sample point collocated with the MINICAMS® to confirm a MINICAMS® alarm if necessary. For example, if the MINICAMS® unit monitoring for HD alarms, then the confirmation sample is collected and sent to the MASP for analysis on an HP Dynatherm GC.

The exact MINICAMS® reading in units of CCL and the specific compound that the unit detected must be identified clearly on the sample collection information sheet for the confirmation sample. The DAAMS confirmation sample collection point for L, HD, HN-1, and HN-3 is directly from the carbon filter system near the MINICAMS® sample point. It is critical that the confirmation sample collection port collects a sample that is as close as possible to the MINICAMS® collection point at that location.

8-4-5 Carbon Filter System Exhaust

There are three types of monitoring conducted in the filter exhaust system: 1) MINICAMS® as required, 2) confirmation, and 3) historical. MINICAMS® collect a sample from this location (when breakthrough of the coconut or ASZM-TEDA first filter element is detected during operational hours and during non-operational days).

The DAAMS confirmation sample is used to confirm an agent MINICAMS® alarm. The colorimetric tube sample is only collected if a MINICAMS® alarm has occurred at the exhaust stream of the carbon filter for chloroform, PS, CK, and/or CG. The length of stain on the colorimetric tube is observed and recorded by the operator on a sample collection form.

The historical DAAMS sample station in the carbon filter exhaust is downstream of all carbon air filter elements. Historical DAAMS samples are collected during operational hours only. Sample ports are available on the historical DAAMS sample station for the daily QP sample of HD, HN-1, and HN-3. QP samples are collected and analyzed with every sequence of DAAMS tubes for Lewisite.

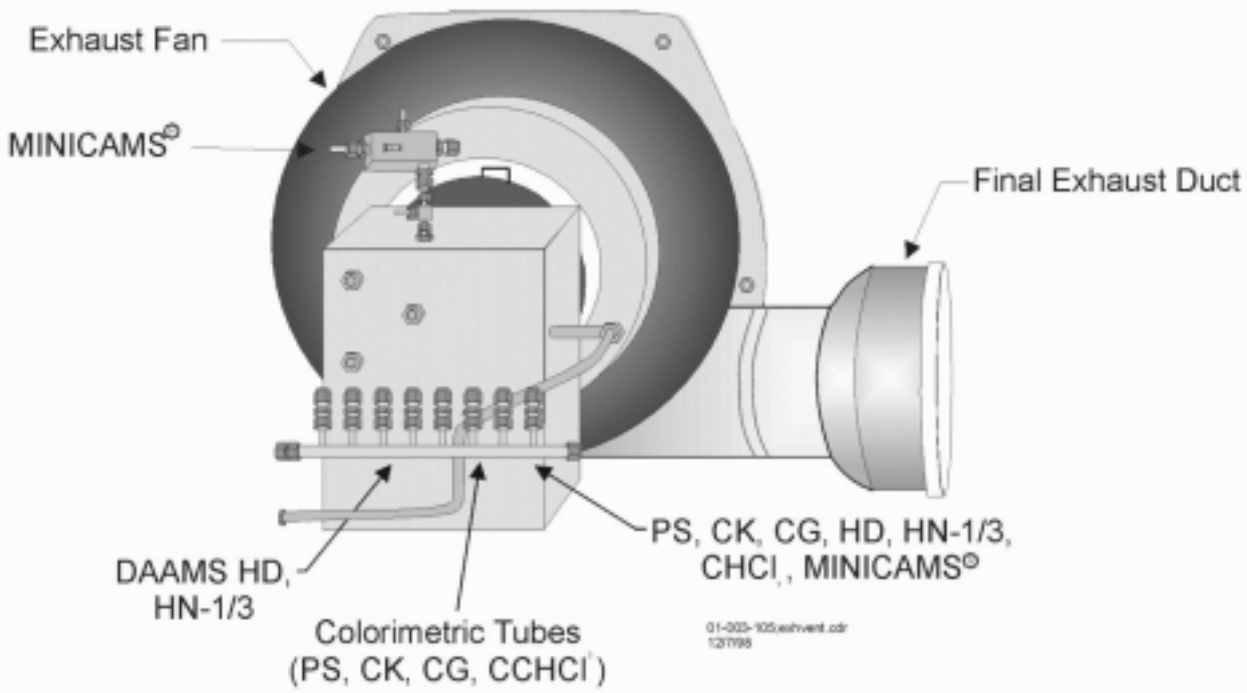

Figure 8-15.
Carbon Filter System Exhaust Vent Sample Station

8-4-6 MASP

The MASP workspace and the filter midbed will be monitored continuously using DAAMS for mustard (H,HD), nitrogen mustard (HN-1, HN-3), and Lewisite (L). Colorimetric tubes that are collected every 60 minutes while the MASP is occupied will be used to monitor for chloroform.

8-4-7 Quality Control Sample Requirements

After calibration, if an instrument is used to quantitate the amount of analyte in a sample, it is subjected to periodic QC sample analysis to check the measurement process from sample collection through analysis. The QC samples are used to:

- Evaluate the accuracy and precision of analytical data to establish the quality of the data
- Provide an indication of the need for corrective actions
- Determine the effectiveness of corrective actions when they are implemented.

The MASP that supports RRS operations analyzes numerous types of QC samples to inspect the measurement process. QC samples provide data that can validate the results of the analysis of an actual sample. The following types of QC samples are analyzed by the MASP during routine operations:

- Blanks;
- Replicates;
- Calibration checks;

- o Matrix spikes;
- o Field spikes; and
- o Laboratory spikes.

A detailed discussion of these QC samples and their use is provided in the QCP.

Table 8-3.
Air Monitor Assignments and Locations

	MINICAMS® [a]	Historical DAAMS [b]	Confirmation DAAMS [b]	Colorimetric Tubes [c]
Glovebox	X			X
Coconut charcoal filter	X			X
ASZM-TEDA carbon filter	X		X	X
Carbon filter exhaust	X	X	X	X
RRS trailer workspace	X	X	X	X
MASP workspace		X		
MASP filter midbed		X		

Notes:
[a] MINICAMS® monitor for PS, CK, CG, L, HD, HN-1, HN-3, and $CHCl_3$
[b] DAAMS monitor for HD, L, HN-1, and HN-3
[c] Colorimetric tubes monitor for PS, CK, CG, and $CHCl_3$
DAAMS = Depot Area Air Monitoring System
RRS = Rapid Response System

8-5 Field Monitoring Procedures

Before RRS operations begin in Building 4553, the air monitoring equipment is required to undergo a baseline monitoring assessment to verify that all of the monitoring systems are prepared to accurately detect the presence of chemical materiel in the air.

8-5-1 Site Sampling for Interferences During Baseline Studies

Chemical interference's present in Building 4553 could cause unnecessary false positive readings for air monitoring equipment measurements. This problem is assessed during the 3-day baseline study by collecting and analyzing confirmation samples. During this period, confirmation samples are collected once per shift. The time of day for sampling is selected to match the greatest amount of activity expected during the RRS test. Each day's confirmation samples are analyzed by the MASP operators.

Results indicating significant background interferences for monitoring are immediately reported to the RRS supervisor and RRS test director. If possible, the source(s) of the interference(s) are identified and eliminated or controlled.

8-5-2 Initial Startup and Monitoring Equipment at Building 4553

The MINICAMS®, gas supply system, stream selection system, DAAMS confirmation sample stations, DAAMS historical stations and sampling and return lines are inspected for evidence of physical damage. Where damage is noted, broken items are repaired or replaced immediately. Routine preventive maintenance operations, such as replacing MINICAMS® PCTs, are also completed at this time.

The stream selection systems and the heat-traced sampling lines are turned on and allowed to warm up for 30 minutes.

Vacuum pumps are turned on and allowed to run throughout the inspection period. The flow rate of air through each sampling line is measured and adjusted for site operating conditions, as necessary. Heat-traced sample line integrity is checked by capping the distal end of each heat-traced sample line and verifying zero flow at the monitoring station.

The computer printer and floppy disk drive connections to the MINICAMS® are verified and each unit is turned on and allowed to warm up. The supply of hydrogen, purified air, and nitrogen gas, and 1,2-ethanedithiol (EDT) from the compressed gas cylinders to the MINICAMS® is established. The pressurized hydrogen gas supply lines are monitored for leaks at all connection points, and any identified leaks are eliminated immediately.

After the each MINICAMS® unit is turned on, the operating parameters for each MINICAMS® is reviewed, adjusted to specified parameters, and printed out. The printouts are placed into permanent storage in the appropriate RRS monitoring files. The MINICAMS® analysis protocols are adjusted at this time if significant interferences have been identified in paragraph 8.5.1.

All laboratory and monitoring equipment is then calibrated in accordance with the QCP.

Sample Line Challenge. Sample lines are challenged to verify that transmission of chemical materiel from the sampling points to the MINICAMS®/DAAMSis acceptable. The distal end of the workspace, ASZM-TEDA carbon filter elements, carbon filter system exhaust, and glovebox heat-traced sampling lines are challenged separately with 1.0 CCL of each chemical materiel at the beginning of the test and weekly thereafter for H, HN-1, and HN-3, and are challenged daily for Lewisite. Each heat-traced line is considered ready for operations if the MINICAMS® readings are within 25 percent of the target challenge level for each chemical. If unacceptable readings are obtained, a second challenge is made for the chemicals that were out of range. If the readings continue to be unacceptable, corrective actions are taken to improve heated sample line transfer.

8-5-3 Daily Startup

On the first day of each week of RRS operations, MINICAMS® are calibrated at 1.0 CCL. At the beginning of all site operational days, each MINICAMS® is challenged at 0.2 and 1.0 CCL for H, HN-1, and HN-3, and 0.5 CCL and 1.0 CCL monitoring level for Lewisite. When the MINICAMS® are ready for operations, the stream selection systems are set to alternately monitor the operations trailer workspace and between the coconut shell and ASZM-TEDA carbon filter elements. Confirmation and historical DAAMS sample tubes are placed in each sampling station and the sampling station sequencers. Historical DAAMS sample stations are programmed for the correct start/stop times and started. All monitoring must be operational before waste treatment may begin.

8-5-4 Rapid Response System Operations

MINICAMS® *Operations.* MINICAMS® operate until the glovebox undergoes closure. Compressed gases, chemical reagents, and other consumables associated with daily MINICAMS® operation are replenished as needed.

Historical Sample Collection and Analysis. Historical samples are collected and analyzed during operational hours of RRS operations. For normal operations, samples are removed and replaced with clean DAAMS tubes after the sampling station sequencer has turned off. Flow rates are measured and adjusted during DAAMS tubes installation, and measured during collection.

Each QP sample is spiked at the CCL level with RRS standards immediately before sampling. Once collected, QP samples are analyzed in the MASP. Results deviating by more than 25 percent from the monitoring level are reported immediately to the RRS supervisor for corrective action. Corrective action is initiated by the MASP chemist. All QP sample results will be maintained in the Operating Record.

Confirmation Sample Collection and Analysis. Confirmation samples collected at the RRS operations trailer workspace, from between the ASZM-TEDA carbon filter elements and carbon filter exhaust monitoring stations are analyzed at the MASP for chemical agent. Samples collected at alarm locations are analyzed. DAAMS tubes collected at locations that have not experienced a MINICAMS® alarm are blanked.

If a MINICAMS® detects HD, HN-1/HN-3, or L at the workspace station, confirmation DAAMS samples for the detected chemical materiel are analyzed by the MASP. If a MINICAMS® detects HD, HN-1/HN-3, or L between the ASZM-TEDA carbon filter elements, confirmation samples taken between the ASZM-TEDA carbon filter elements and exhaust historical samples for the detected chemical materiel are analyzed by the MASP. If confirmed, carbon filter elements are changed. After the filters are changed, the samples are analyzed by routine sample analysis.

Monitoring Leaker PIGs and Overpacks and Responding to Spills in the Glovebox. The initial step when discovering a leak or responding to a spill of CAIS materiel in the unpack station of the glovebox is to reduce the spread of contamination. If a liquid spill is obvious, contamination is reduced by using absorbent towels. The next step is to separate all intact CAIS items. This eliminates further spreading of CAIS contamination and prevents further breakage of intact CAIS items.

If the suspected leak is from a known or marked container, the operator first uses the appropriate colorimetric tube to confirm the chemical agent. The colorimetric tube sample is collected directly over the suspected leak materiel or liquid for the initial monitoring. Table 8-4 lists possible colorimetric tubes used for this detection.

After identification of the spilled materiel, chemical-agent-contaminated items are treated with the treatment reagent/cosolvent mixture or bleach in the catch tray and industrial chemical-contaminated items are disposed of in the solids hazardous waste drum. After decontamination, a piece of each type of waste in the catch tray is set aside and collected in a sample jar as a solid sample for chemical agent analysis, and for waste characterization. Each load decontaminated in the catch tray undergoes this process to provide a representative sample of all contents of the solids drum. After sample collection operations have been completed, final monitoring of the unpack station is performed to ensure that the decontamination procedures have been effective. For chemical agents, gross-level colorimetric tubes may be used first. If gross levels are not detected, MINICAMS® are used to confirm decontamination of the chemical agent in question. For industrial chemicals, only colorimetric tubes are used; MINICAMS® are not required due to the colorimetric tube's low detector limit. If positive results are obtained from gross-level monitoring, the decontamination procedures are repeated until the necessary negative results are obtained.

Hazardous Waste Drum Removal. The hazardous waste drum openings are vented into the unpack and neutralization stations of the glovebox to allow all necessary monitoring procedures to take place under engineering controls. A liquid and or solid sample is removed from the hazardous waste drum and is sent to the MASP for analysis. If treatment residue analyses by the MASP determine that HD, HN-1/HN-3, or L is present in a stored drum at concentrations exceeding the treatment levels, additional decontamination or treatment reagent is added to the drum until these treatment levels are met. Samples of the decontaminated material are returned to MASP for repeat chemical agent analysis. When the results of the laboratory analyses indicate adequate treatment has been achieved, the drums are prepared for transportation to an approved appropriate hazardous waste treatment, storage, and disposal facility (TSDF).

Small amounts of chemical agent are treated in the reactor and emptied into the liquid hazardous waste drum. Excess amounts of treatment reagent are used for the treatment reactions, and as a result, no chemical agents are expected in the liquid or solid hazardous waste drum above the treatment levels. A representative sample is taken for chemical agent analysis at the MASP. After they are full, they are sealed, monitored to ensure they have not been contaminated during operations, removed from underneath the glovebox, and placed into temporary storage in the waste staging area within Building 4553.

Table 8-4.
Colorimetric Tubes

CAIS Materiel	Colorimetric Tube	Range
Mustard Sulfur (HD)	Draeger CH 25803 or equivalent	qualitative low limit = 1.0 mg/m^3
Nitrogen (HN-1/HN-3)	Draeger CH 25903 or equivalent	qualitative low limit = 1.0 mg/m^3
Lewisite (L)	Draeger CH 26303 or equivalent	qualitative low limit = 3.0 mg/m^3
Chloropicrin (PS)	ENMET 90172-000 or equivalent	0.1-15 ppmv (0.1 ppmv = 1 TWA)
Cyanogen Chloride (CK)	Draeger CH 19801 or equivalent	0.25-5 ppmv (0.3 ppmv = 1 TWA)
Phosgene (CG)	Draeger CH 19401 or equivalent	0.02 to 0.6 ppmv (0.1 ppmv = 1 TWA)
Chloroform ($CHCl_3$)	Draeger CH 2886	2-10 ppm 1 TWA = 2 ppm

Notes: ppmv = parts per million volume
TWA = time-weighted average

Glovebox Decontamination. The interior of the glovebox is decontaminated only when necessary. The neutralization station may be decontaminated using the treatment reagent/cosolvent mixture or bleach as appropriate for the color coded treatment process that was last conducted. The unpack and airlock stations are decontaminated with 5 percent sodium hypochlorite (NaOCl) applied with squeeze bottles and spread with disposable wipes or brushes, as appropriate, rinsed with water, and allowed to air dry. Contact time of the decontamination treatments is a minimum of 15 minutes. Upon completing decontamination procedures, the interior of the glovebox is surveyed with colorimetric tubes appropriate to the chemicals last processed. If contamination is detected, the glovebox is decontaminated again as previously described, and monitored again for the detected chemical materiel. When colorimetric tubes no longer indicate the presence of HD, HN-1/HN-3, or L, RRS personnel slowly sample the four corners and center of the glovebox with the MINICAMS® glovebox wand. If all the MINICAMS® readings are below the CCL, the glovebox has been successfully decontaminated for ventilated conditions.

8-5-5 Rapid Response System Closeout Monitoring

After CAIS materiel processing is completed, the glovebox is decontaminated in accordance with the Closure Plan.

8-6 Equipment Support Requirements

8-6-1 MINICAMS®.

a. *Electrical Requirements.* Power filters and a backup generator are used to ensure a stable source of power for the MINICAMS® equipment at 110 to 130 volts alternating current. Heated sample transfer lines can require as much as 5 to 10 amperes of current for routine operations and 10 to 20 amperes when first bringing the lines up to operating temperature.

b. *Interferences.*

(1) *Chemical Interferences.* To minimize the likelihood of false alarms, the exposure of the monitors to vehicle exhaust, forklift exhaust, and diesel generator exhaust is minimized. Vehicle and equipment exhausts are minimized by operating vehicles in Building 4553 only when necessary and opening all doors during operations. The utility trailer and MASP are employed at the northeast side of Building 4553.

MINICAMS® are used only in a noncorrosive environment and are not used to sample freshly prepared corrosive decontamination solutions. Items that have been decontaminated are allowed to dry before sampling.

(2) *Electrical Interferences.* Hand-held radios or cellular phones are not operated within 15 feet of the MINICAMS® (the radio frequencies interfere with the proper operation of the analytical equipment). Signs are posted at a 15-foot radius around the MINICAMS®, warning site personnel not to use hand-held radios or cellular phones beyond the posted point.

c. *Heat-traced Sample Lines.* Most heated sample transfer lines are one continuous piece of heat-traced Teflon tubing with minimized length. All heated sample transfer line connections are airtight, locked in place, and protected from routine RRS test traffic, crimping, nicks, and cuts to prevent any breaks in the sample line integrity. The heated sample transfer lines are cleaned and conditioned according to the manufacturer's recommendations.

The sample vacuum pump exhaust lines are exhausted to the glovebox carbon filter system upstream of the sample point. This ensures that the sample pump exhaust lines enter the filter system upstream of the filter sample ports and upstream of the prefilter.

d. *Preconcentrator Tubes.* The solid sorbent tube used to collect the sample in the MINICAMS® is referred to as a PCT. The PCT in every MINICAMS® is replaced at the beginning of the RRS test and every seven calendar days. New PCTs are preconditioned before MINICAMS® calibration by cycling until a flat baseline is established. Preconditioning is complete once the baseline has stabilized.

e. *Compressed Gases.* The compressed gases required for MINICAMS® operation (hydrogen, air, and nitrogen) are located at the trailer exterior. The gases are required to be at least 99.99 percent pure. The compressed gases are purified further by filtering all three compressed gases through a moisture trap, a molecular sieve, and a hydrocarbon trap before connecting them to the MINICAMS®. EDT is required for L derivatization for the L MINICAMS®.

All gas fittings are leak-checked on a routine basis as documented in the preventive maintenance procedures. An electronic leak detector (Gow Mac or equivalent) is used to detect any leaks and to verify the integrity of the compressed gas lines. A soap solution is used only to leak-check the gas cylinder regulator connections; soap solutions are never used when leak-checking the MINICAMS® compressed gas lines or fitting.

When the MINICAMS® are not in immediate use, the compressed gases are shut off at the main stem valve on the compressed gas cylinders.

f. *Environmental Temperature.* The MINICAMS® are maintained at a temperature between 15^0 and 40^0C (59^0 and 104^0F) during operation by the heating, ventilation, and air conditioning (HVAC) system.

g. *Vacuum Pump.* The MINICAMS® requires an oilless pump supplied by the MINICAMS® manufacturer to be used as sample pumps. One pump for all of the MINICAMS® is located in the gooseneck of the RRS process trailer. The preventive maintenance on the pump follows the items and periodicity recommended by the MINICAMS® manufacturer in the MINICAMS® operations and maintenance (O&M) manual. The preventive maintenance responsibilities for the MINICAMS® vacuum pump are the responsibility of NSSC. Each preventive maintenance item is assigned in writing and is required to be documented as part of the Preventive Maintenance File in the RRS air monitoring files.

h. *Calibration and Challenge Solutions.* Challenging the MINICAMS® requires the use of chemical standard reference solutions. All chemical solutions are transported in a container to preclude breakage and provide secondary containment. The chemical challenge solutions are no more than 2 milliliters of solution sealed in a vial. The vial is labeled in accordance with the OSHA Employee Right-to-Know labeling requirements, Army Regulation (AR) 385-61, and states the contents of the vial and the vial tracking number. The vial is placed in the carrier. Caution is taken to prevent degradation. Septa in vials are disposed of and replenished on the day of use.

i. *Syringes.* Hamilton Model 701 N syringes, or equivalent, are used to calibrate or challenge the MINICAMS®. The syringes are flushed with clean solvent prior to each use. A separate, labeled, Hamilton syringe is used for each of the calibration solutions to prevent cross-contamination between the different chemicals used in calibration.

8-6-2 Depot Area Air Monitoring System

a. *Electrical.* Power filters are used as a minimum to protect the DAAMS sample pump. A backup power supply is used to ensure continuous air monitoring.

b. *Chemical Interferences.* In order to minimize the likelihood of false positive samples, exposure of the DAAMS tubes to vehicle exhaust, forklift exhaust, and diesel generator exhaust, is minimized.

c. *Heat-traced Sample Lines.* All DAAMS heated sample transfer line requirements are consistent with those presented in paragraph 8-6-1.

d. *Sample Tubes.* An HP Dynatherm tube (also known as a DAAMS tube) is used to collect the sample in the DAAMS sample station. Before being placed in the field, every DAAMS sample tube is visually inspected for proper bed depth, proper bed location, proper sorbent color, and the absence of gaps in the sample bed. If the DAAMS sample tube fails the visual inspection, it is immediately disposed of appropriately. The pressure drop across each individual DAAMS sample tube lot, documented by the DAAMS tube manufacturer or the MASP, will be confirmed by Rapid Response Sytem Personnel for each DAAMS tube lot. A record of the manufacturer or MASP certification of performing the pressure drop test is maintained for each DAAMS tube lot in the DAAMS Tube Pressure Drop Inspection files in the RRS air monitoring records maintained by NSSC.

e. *Environmental Temperature.* The vacuum pump motors at the DAAMS sample stations are rated for operation in an ambient temperature of 40^0C (104^0F) and a temperature rise on the motor windings to 40^0C (104^0F). The motors have internal thermal protection and shutdown if they overheat. The DAAMS sample stations are located in the operations trailer workspace that is maintained at an appropriate temperature by the HVAC. The motor current is monitored by the control system and the operators are alerted when the motors unexpectedly turn off.

f. *Sample Station Vacuum Pump.* Oilless vacuum pumps are used as sample pumps for the DAAMS sample stations. The preventive maintenance on the vacuum pumps follows the items and periodicity recommended by the vacuum pump manufacturer. Each preventive maintenance item is assigned in writing and is documented as part of the Preventive Maintenance file in the RRS air monitoring files maintained by the NSSC.

g. *Challenge Solutions.* Challenging of the DAAMS sample station requires the use of chemical standard reference solutions.

h. *Syringes.* Hamilton Model 701 N syringes, or equivalent, are used to spike a DAAMS tube with a challenge solution.

8-6-3 Colorimetric Tubes

a. *Observation periods.* Tubes are observed continuously during the measurement, and the indication is evaluated immediately following the measurement according to the instructions for use.

b. *Lighting.* Where possible, the tubes are not stored in direct sunlight to prevent degradation of the tubes. To aid in observation, the tube may be held against a piece of white paper or other light-colored background and compared with an unused tube.

c. *Nondistinct Endpoint.* If colorimetric sample results are not readily interpretable, a second sample is collected on a new colorimetric tube. If the problem persists, the following applies:

- In the event of a nondistinct endpoint, the entire length of the discoloration is read, and all colors noted.
- If the color indication runs at a slant to the tube, the concentration is read as the average endpoint.
- If the color is progressively diffuse, the lowest point of clear discoloration will indicate the concentration to be reported.

d. *Humidity.* Upper and lower humidity limits are provided in the operating instructions for the specific tube. If the measured humidity is outside these limits, the tube is not used and the Site Manager or SSHO is notified.

e. *Temperature.* The ambient operational temperature limits are provided in the operating instructions for specific tubes. If the measured temperature is outside these limits, the tube is not used and the Site Manager or SSHO is notified.

f. *Expiration Dates.* The expiration date is stamped on the detector tube box and is checked before use. Expired tubes are not used. Previously opened tubes are not used, even if the indicator is not stained.

g. *Pump.* The pump is checked for leaks before and after use. The pump volume is calibrated quarterly, according to manufacturer's recommendations (see manufacturer's O&M).

h. *Storage.* Tubes are stored between 0^0 and 25^0C (32^0 and 77^0F), in accordance with manufactures recommendations.

i. *Disposal.* Tubes that have been used are discarded or managed appropriately.

8-4 Response to Alarms

8-4-1 Operations Trailer Workspace Alarm Without Loss of Engineering Controls

When a MINICAMS® alarms indicating chemical materiel is present at the alarm setpoint or higher levels in the operations trailer workspace, RRS personnel immediately don their escape masks, evacuate the operations trailer, and confirmation monitoring is performed. This alarm also sounds outside the operations trailer to alert personnel to don their respiratory protection mask and report to the Emergency Personal Decontamination Station (EPDS) for further instructions. One glovebox operator and one MINICAMS® monitoring specialist may remain in the operations trailer, donned in an escape mask to determine the cause of the alarm. The operators do not remain in the operations trailer longer than one complete MINICAMS® cycle following the alarm to limit exposure for airborne chemical material.

The RRS supervisor selects an emergency response team to reenter the operations trailer dressed in OSHA Level B with self-contained breathing apparatus (SCBA) to collect confirmation samples. If the MINICAMS® alarm is for PS, CG, CK, or $CHCl_3$, the appropriate colorimetric tube is used to confirm the MINICAMS® reading. If the MINICAMS® alarm is for HD, HN-1, HN-3, or L, the appropriate DAAMS confirmation sample is collected and analyzed by the MASP operators.

If MINICAMS® alarms continue and confirmation samples do not confirm the presence of chemical materiel, RRS personnel do not introduce any additional chemical materiel into the glovebox until the source of the false alarm is identified.

8-4-2 Operations Trailer Workspace Alarm with Loss of Engineering Controls

If a MINICAMS® alarms indicating there is a concentration of chemical agent or selected industrial chemical above the alarm setpoint in the workspace area and there is a loss of negative pressure in the glovebox system, all operators are required to don their escape masks and evacuate the operations trailer immediately. This alarm also sounds outside the operations trailer to alert outside personnel to don their respiratory protection. At the sound of the alarm, all personnel in the operations trailer put down anything they are holding in a secure position, don their escape masks, and evacuate the operations trailer. The operations office has a MININET terminal that has the same display as the MININET terminal inside the operations trailer. The MININET terminal can be used to determine which MINICAMS® generated an alarm and where it was sampling from at the time. The MINICAMS® operator checks the MININET terminal inside the operations office to determine the cause of the alarm. Personnel evacuating the operations trailer report to the EPDS for further instructions. The RRS supervisor accounts for the safety of the RRS crew and notifies the Chemical Accident/Incident Control Officer if a chemical agent is released outside the engineering controls of the glovebox.

The RRS supervisor surveys the situation, develops an emergency response plan to determine the source of the alarm, selects the emergency response team, and briefs RRS personnel on the emergency response plan. Personnel reentering the operations trailer don appropriate personal protective equipment (PPE). The emergency response team silences the MINICAMS® alarm, determines the reason for loss of negative pressure within the glovebox, performs confirmation monitoring, and collects DAAMS tubes for confirmation samples.

8-4-3 Alarms Between the Coconut Shell and ASZM-TEDA Carbon Filter Elements

If the MINICAMS® alarms indicate the breakthrough of chemicals between either the coconut shell carbon filter elements or the ASZM-TEDA carbon filter elements, confirmation samples are collected and analyzed. Personnel proceed to complete operations in progress and secure the system (all PIGs unpacked, no reactions in progress, all CAIS items stored in holding cans). The filter elements are changed out as soon as possible. No treatment processes will be restarted until the filter elements have been changed.

8-4-4 Positive Reading at the Carbon Filter System Exhaust

If chemical levels equal to or exceeding the alarm setpoint are detected at the carbon filter system exhaust, all CAIS operations stop immediately and all RRS personnel dress in higher levels of PPE appropriate to the hazard. The RRS supervisor and the DCD Operations Center are informed immediately of the situation. The carbon filter induction fan is turned off and the intake and exhaust ducts of the carbon filter system are closed. The glovebox inlet duct is closed. If the alarm is confirmed, both elements of the carbon filter system are changed out. CAIS operations may resume at the direction of the RRS supervisor.

8-4-5 Equipment Decontamination

Equipment used outside the RRS glovebox is not contaminated under routine operations. Should chemical agent be detected outside of engineering controls and equipment be potentially contaminated, that equipment is monitored and decontaminated, if necessary, in accordance with the DCD CAIRAP. Equipment that becomes contaminated because of a spill of industrial chemicals is decontaminated by NSSC personnel in accordance with the DCD Installation Spill Contingency Plan or, if hazardous waste is spilled, in accordance with the DCD Hazardous Waste Contingency Plan.

8-5 Preventive Maintenance

Preventive maintenance ensures that the sampling and analysis equipment is in the proper operating condition, and prevents problems before they affect the validity of the data. The hardware associated with sampling and analysis is maintained in accordance with the manufacturer's recommendations. The preventive maintenance activities are documented and supported by a preventive maintenance schedule.

Preventive maintenance of field monitoring equipment is performed by the NSSC in accordance with the MINICAMS® O&M manual or the vendor's recommendations. For analytical equipment located in the MASP, preventive maintenance is performed in accordance with the manufacturer's recommendation and on an as-needed basis as deemed necessary by the MASP chemist.

The instrument, including manufacturer, model, accessories, etc., is specified in the preventive maintenance records. Preventive maintenance is performed by qualified personnel.

Preventive maintenance records consist of documentation proving that the manufacturer's preventive maintenance recommendation was followed. A preventive maintenance schedule is generated and followed during the test. The preventive maintenance records are maintained by the NSSC and include information on the replacement of parts or the adjustment of an instrument during routine operations. Once the preventive maintenance documentation is complete, it is placed immediately in storage or filing location under controlled access to prevent any loss or change in the data.

8-6 Corrective Action

Corrective action is initiated through the development and implementation of routine internal QC checks. Corrective action is initiated when potential or existing conditions are identified that may adversely impact data quality. Events that require corrective action to be taken include violation of approved analytical procedures, violation of approved SOPs, out-of-control conditions, absence of proper nonconformances, and inability to attain data quality objectives (DQOs) as described in the QCP.

The need for corrective action must be documented immediately and reported to the RRS QA Manager and RRS supervisor. The corrective action may be immediate or long-term. An immediate corrective action may be the recalculation of results, reanalysis of samples, or repeat of sample collection. A long-term corrective action may include an increase in QC samples, more frequent calibrations, implementation of control charts, or additional backup equipment.

All corrective actions taken are documented in the appropriate instrument logbook. If the DQOs established in the QCP cannot be met, the data are analyzed to identify the usability of the information generated. If necessary, the DQOs may need to be revised to meet personnel, equipment, or analytical method capabilities.

For any non-operator induced MINICAMS malfunction, treatment operations in progress will be continued to completion and the system secured. No further waste will be introduced until the malfunction is corrected. If the malfunction occurs during operating hours, historical DAAMS tubes analytical results will be documented in the Operating Record for that time period.